

Figure 1

| | | Cutting Speed | d Fuzzy Model | | Feed Rate Fuzzy Model | | | | |
|--------------------|--|---------------|--------------------------|--------------------------|-----------------------|------------------------|--------------|------------|--|
| Index represent | 1 st input (material hardness) 2 nd inpu | | 2 nd input (d | depth of cut) Input (dep | | pth of cut) Output (fo | | feed rate) | |
| ation | Abbreviation | Expression | Abbreviation | Expression | Abbreviation | Expression | Abbreviation | Expression | |
| 0 | VS | Very Soft | VS | Very Shallow | VS | Very Shallow | VS | Very Slow | |
| 1 | S | Soft | S | Shallow | S | Shallow | S | Slow | |
| 2 | MD | Medium | MD | Medium | MD | Medium | MD | Medium | |
| 3 | Н | Hard | Н | Deep | Н | Deep | F | Fast | |
| 4 | VH | Very Hard | VH | Very Deep | VH | Very Deep | VF | Very Fast | |

Figure 2

| Index representation | Abbreviation | Expression |
|----------------------|--------------|---------------------|
| 0 | EVS | Extremely very slow |
| 1 | ES | Extremely slow |
| 2 | VVS | Very very slow |
| 3 | VS | Very slow |
| 4 | S | Slow |
| 5 | QS | Quite slow |
| 6 | AS | A bit slow |
| 7 | MD | Medium |
| 8 | AF | A bit fast |
| 9 . | QF | Quite fast |
| 10 | F | Fast |
| 11 | VF | Very fast |
| 12 | VVF | Very very fast |
| 13 | EF | Extremely fast |
| 14 | EVF | Extremely very fast |

Figure 3

| Tool Type | 1st i | input | 2nd input Outpu Depth of cut Cutting s | | Output | |
|-----------------------------|----------|----------|---|-----|---------|-----|
| | Material | hardness | | | g speed | |
| | Min | Max | Min | Max | Min | Max |
| High-speed steel | 85 | 275 | 0 | 16 | 16 | 59 |
| Uncoated brazed carbide | 85 | 275 | 0 | 16 | 60 | 172 |
| Uncoated index able carbide | 85 | 275 | 0 | 16 | 63 | 225 |
| Coated carbide | 85 | 275 | 0 | 16 | 105 | 336 |

Figure 4

| Material | | | Depth of o | cut | |
|----------|-----|----|------------|-----|-----|
| Hardness | VS | S | MD | . D | VD |
| VS | EVF | MD | AS | QS | VS |
| S | F | QS | S | VS | VVS |
| MD | F | S | S | VVS | VVS |
| Н | QF | S | VS | VVS | ES |
| VH · | MD | ES | ES | ES | EVS |

Figure 5

| Material | | | Depth of c | ut | |
|----------|-----|----|------------|-----|-----|
| Hardness | VS | S | MD | D | VD |
| VS | EVF | MD | AS | QS | VVS |
| S | F | QS | S | VS | VVS |
| MD | F | S | S | VVS | ES |
| Н | QF | S | VS | VVS | ES |
| VH | AF | S | VS | VVS | EVS |

Figure 6

| Material | | | Depth of c | ut | |
|----------|-----|----|------------|-----|-----|
| Hardness | VS | S | MD | D | VD |
| VS | EVF | QS | QS. | S | VS |
| S | VVF | S | S | VS | VVS |
| MD | F | QS | S | VVS | ES |
| Н | AF | S | VS | VVS | EVS |
| VH | AF | ES | ES | ES | EVS |

Figure 7

| Material | | | Depth of c | ut | |
|----------|-----|----|------------|-----|-----|
| Hardness | VS | S | MD · | D | VD |
| VS | EVF | MD | AS | QS | S |
| S | VF | QS | S | VS | VVS |
| MD | F | S | S | VVS | VVS |
| Н | QF | S. | VS | VVS | EVS |
| VH | MD | VS | ES | ES | EVS |

Figure 8

| | Input | , | Output | | | |
|----------------|-------------|----------|----------------|-------------|-----------|--|
| Fuzzy | Universe of | Depth of | Fuzzy | Universe of | Feed rate | |
| expression | fuzzy | cut (mm) | expression | fuzzy | (mm/r) | |
| (abbreviation) | membership | | (abbreviation) | membership | | |
| VS | 0 | 0 | VS | 0 | 140 | |
| | 1 | 1.5 | | 1 | 180 | |
| | 0 | 2.5 | | 0 | 220 | |
| S | 0 | 1.5 | S | 0 | 200 | |
| ; | 1 | 3.5 | | 1 | 360 | |
| | 0 | 5.5 | | 0 | 520 | |
| M | 0 | 2.5 | MD | 0 | 220 | |
| | 1 | 8.25 | | 1 | 465 | |
| | 0 | 14 | | 0 | 710 | |
| D | 0 | 5.5 | F | 0 | 520 | |
| | 1 | 10.5 | | 1 | 640 | |
| | 0 | 16 | | 0 | 720 | |
| VD | 0 | 14 | VF | 0 | 710 | |
| | 1 | 16 | | 1 | 750 | |
| | 0 | 18 | | 0 | 790 | |

Figure 9

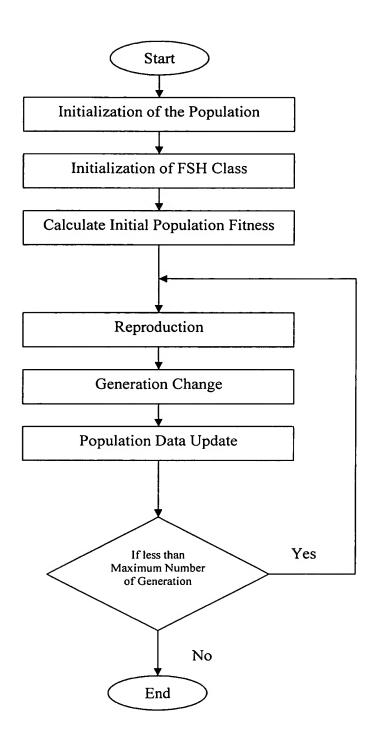


Figure 10

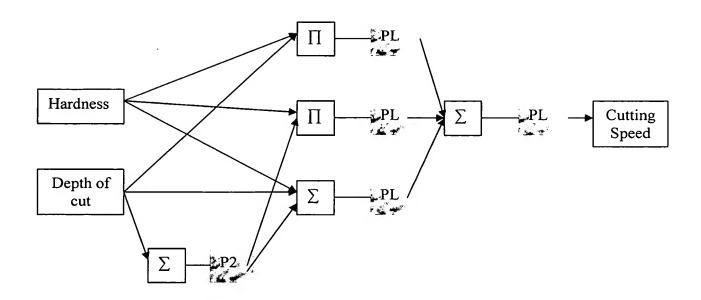


Figure 11